Finance and Economics Discussion Series
Divisions of Research & Statistics and Monetary Affairs
Federal Reserve Board, Washington, D.C.

Consumer Switching Costs and Firm Pricing: Evidence From Bank Pricing of Deposit Accounts

Timothy H. Hannan

2008-32

CONSUMER SWITCHING COSTS AND FIRM PRICING: EVIDENCE FROM BANK PRICING OF DEPOSIT ACCOUNTS

by

Timothy H. Hannan*

This paper employs extensive information on bank deposit rates and county migration patterns to test for pricing relationships implied by the existence of switching costs. While these relationships are derived formally, the intuition for them can be readily stated. Because some areas experience more in-migration than others, banks, in addressing the trade-off between attracting new customers and exploiting old ones, offer higher deposit rates in areas (and at times) experiencing more in-migration. Further, because out-migration implies that on average a locked-in customer will not be with the bank as many periods, greater out-migration should change the bank's assessment of this trade-off such that the bank will offer lower deposit rates in areas (and during periods) exhibiting greater out-migration, all else equal. Also, because this effect of out-migration logically depends on the existence and extent of in-migration, an interaction effect is implied. Evidence strongly supporting these implied relationships is reported. Other tests of the implications of switching costs in the banking industry are also conducted.

Classification Codes: L11, L13, D43, G21

May 12, 2008

Senior Economist, Federal Reserve Board.
The views expressed herein are those of the author and do not necessarily reflect the views of the Board of Governors of the Federal Reserve System or its staff. The author would like to thank Elizabeth Kiser, Robert Adams, and Ron Borzekowski for helpful comments and Miranda Mei for excellent research assistance.

Consumer Switching Costs and Firm Pricing: Evidence from Bank Pricing of Deposit Accounts

1. Introduction

For many different products and services, consumers who have purchased from one firm incur (or perceive to incur) costs if they switch to a competitor's offering. Examples are the costs associated with learning to use a new brand, the need for compatibility with existing equipment, the costs of overcoming uncertainty about the quality of unfamiliar brands, the psychological switching cost associated with "brand loyalty," and, of course, the more direct, actual transaction costs that are sometimes incurred to change brands. An example of this latter type of switching cost is the high transaction costs that a depositor incurs when changing banks. This requires not only the closing of one account and the opening of another, but in recent years it has come to mean also the notification of employers regarding automatic deposit of wages and notification of potentially numerous commercial enterprises regarding authorized electronic withdrawals (automatic or otherwise).

It has long been recognized that the existence of such switching costs can have significant implications for the pricing of products for which such costs are likely to be important. The exact implications derived from theory depend on the underlying model employed. The simple (and naïve) one-period model, wherein all customers are locked in and there are no new customers to attract, yields monopoly pricing when switching costs are high enough. The more commonly presented two-period model, wherein customers purchase a service or commodity in the first period and are "locked in" in the second period, yields high prices in the second period but (depending on assumptions) can

produce prices below those associated with short-run profit maximization in the first period. The intuition, of course, is that first period prices are lower because firms compete for customers that they can exploit in the second period.

However, a two-period model is not very useful for analyzing pricing in the general case in which new customers are entering the market each period, some customers are leaving the market each period, and firms are unable to discriminate between new and old customers. A model designed to address the pricing implications of switching costs in this context has been developed by Beggs and Klemperer (1992), who report that under assumptions that they regard as most plausible, prices and profits are higher in the presence of switching costs.[1] They also show that prices rise as firms discount the future more, fall as consumers discount the future more, fall as the turnover of consumers increases, and fall as the rate of growth of the market increases.[2]

In this paper, data from the banking industry are used to test several of the pricing implications of switching costs suggested by the Beggs and Klemperer (1992) model. As noted above, the banking industry is one in which substantial switching costs should be relevant to customer behavior (see Kiser, 2002). More importantly, several different features of the banking industry allow identification of the impact of switching costs on prices over time, across products, and across areas.

The most important of these features is the local nature of bank retail deposit pricing. Despite changes that may have broadened the geographic scope of deposit

---

1 These assumptions are (1) discounting of future profits, (2) the recognition by firms that charging a higher price today will cause rivals to have more locked in customers and therefore charge higher prices tomorrow, and (3) the recognition by customers that responding to a low price today will mean a higher price tomorrow.

2 They also find that larger firms or firms with larger market shares charge higher prices than smaller firms or firms with smaller market shares, but, as noted below, these implications derive from a particular assumption in their model that is not likely to apply in the case of the banking industry.

markets in recent years, competition for many different types of deposit funds is still regarded as local in nature, meaning that pricing of deposit accounts can vary by area (see Amel and Starr-McCluer, 2002). Because some areas experience more in-migration than others, banks, in addressing the tradeoff between attracting new customers and exploiting old ones, should offer higher deposit rates in areas with more in-migration. Further, because out-migration implies that on average a locked-in customer will not be with the bank as many periods, greater out-migration should change the bank's assessment of this trade-off such that the bank will offer lower deposit rates in areas exhibiting greater out-migration, all else equal. Importantly, the variation in in-migration and out-migration, both cross-sectionally and over time, can be employed to test these hypotheses.

Another relevant characteristic of the industry is that switching costs, in all likelihood, have been increasing over time. The reason is the increasing use of direct deposits and arranged withdrawals from transaction accounts, which imply that the cost of switching accounts from one bank to another has, if anything, become greater over time.

A final relevant characteristic concerns the difference in deposit products offered by banks. Of the several different types of deposit accounts that banks typically offer, it is reasonable to presume that some types of accounts (namely transaction accounts) entail higher switching costs than others. The combination of increasing switching costs and differences across products in the importance of switching costs suggests that the predicted decline in deposit rates that results from increased switching costs over time should be more pronounced in the case of account types where switching costs should be more of a factor.

Results show a strong and robust relationship between bank deposit rates and the rates of both market in-migration and market out-migration. As suggested by an application of the Beggs and Klemperer model to the banking industry, deposit rates are found to increase with the rate of migration into a market and decline with the rate of migration out of the market, with the rate of out-migration having a more negative effect on deposit rates, the higher is the rate of in-migration. These results, it will be argued, imply that switching costs are very much a factor in explaining bank deposit rates and that banks consider the future profitability of locked-in depositors in choosing current deposit rates. They are also relevant to antitrust policy, since they suggest that regulatory agencies should, among other things, take into account migration patterns in assessing the competitive effects of proposed bank mergers.

Hypotheses based on the presumed differences in switching costs across the four different types of deposit accounts examined in the study are not as well supported. While the deposit account that should entail the most switching costs does exhibit the largest decline over the most relevant periods examined—a possible implication of rising switching costs—the possibility of other explanations for such cross-product differences implies that this result should be considered at best suggestive.

The plan of the paper is as follows: Section 2 discusses the relevant literature, and section 3 presents a model adopted to develop intuition for the underlying relationships to be examined empirically. Section 4 outlines the tests to be conducted, and section 5 describes the data used. Section 6 presents results, and a final section concludes.

2. The Literature

The theoretical literature on switching costs is vast, and we refer the reader to Klemperer (1995) and Farrell and Klemperer (2006) for extensive reviews of it. Here, we simply note some of its salient aspects. A common fixture in this literature has been the two-period model, wherein firms cannot commit to future prices. Consumers that choose to purchase from a given firm in the first period are "locked in" for the second period. This causes firms to exploit their market power in the second period and price aggressively in the first period because of the monopoly rents in the second period obtainable from first-period customers. This "bargains-then-rip off" pattern is a main theme of many two period models.

Such models can explain some instances of pricing behavior when cohorts can be identified by the firm. An example is when banks offer college students gifts and free services to induce them to open accounts, followed in later years by highly profitable pricing. However, a two-period model is less useful for analyzing competition over many periods when new customers are entering the market in every period, some old customers are leaving, and firms are unable to discriminate between new and old customers. Because the empirical environment that we wish to explore contains all three of these elements, we will employ as a frame of reference in this paper a multi-period model of competition and switching costs presented in Beggs and Klemperer (1992). A detailed discussion of their model is deferred to the next section.

Empirical models of switching costs are far less numerous. Two studies of the banking industry actually report estimates of switching costs. Using highly aggregated data, Kim, et. al. (2003) estimate the magnitude of switching costs by deriving and then

estimating a first-order condition, a market-share equation, and a supply equation under the assumption of Bertrand behavior. Their application of the procedure to Norwegian bank loans yields an estimate of 4.12 percent of the typical customer's loan, which seems quite substantial. Shy (2002), using data on prices and market shares, finds that the costs of switching deposits ranges from 0 to 11 percent for deposit customers of Finnish banks.

Some other empirical studies relevant to the banking industry have sought to test the implications of the existence of switching costs for pricing behavior. Two previous studies of bank pricing have noted that customers that are newly arrived in an area in essence do not face switching costs if their move required that they leave their previous bank, while existing residents could be subject to substantial additional costs if they were to switch their accounts to a new institution. If bank pricing reflects a compromise between exploiting old customers (made possible by switching costs) and attracting new ones, then it follows that banks located in markets with greater in-migration would optimally charge lower prices (offer higher deposit rates), all else equal.

Sharpe (1997), the first to test this implication of switching costs, used data on six-month CD rates and on MMDA rates that were offered by 222 banks located in 105 different local "markets" and observed monthly from October 1983 to November 1987. Defining local banking markets as Metropolitan Statistical Areas (MSAs) or non-MSA counties, Sharpe estimated the proportion of new "movers" in each market from Census data indicating the percentage of households in each area in 1980 that changed residences in the previous five years. Because this period, from 1975 to 1980, predates the period for which deposit rate data were available, Sharpe (1997) employed an extrapolation

procedure that made use of annual information on market population growth to obtain annual estimates of the proportion of movers for the 1983-1987 period. Using a pooled time series of 5 annual cross sections (and adjusting for time effects), Sharpe found that, consistent with predictions, the proportion of household migration in a market has a generally positive (pro-competitive) effect on deposit rates, all else equal.

Although not the primary focus of their paper, Hannan, et. al., (2003) also employed a measure of migration in their investigation of the decision by banks to levy a surcharge for use of their automated teller machines (ATMs) by non-depositors. They report that banks in local markets with higher levels of in-migration are more likely to impose a surcharge-- a finding consistent with the hypothesis that ATM surcharges, because they can attract rather than repel new depositors,[3] are more likely to be imposed in markets where a greater proportion of the population can be more readily attracted. Because of the availability of annual IRS data on household migration for years more recent than those examined by Sharpe (1997) , Hannan, et. al., (2003) use a more direct measure of market in-migration that does not involve a cumbersome extrapolation from migration data applying to earlier periods.

An issue that arises in the use of migration data to proxy customers that do not face switching costs concerns the underlying model that it is supposed to test. If banks do not consider the implications for future periods of attracting new customers in the current one, then new customers influence prices simply because they represent a source of more elastic demand in the current period. This “current-period” analysis is essentially the one modeled and presented by Sharpe (1997). If, however, banks consider the gains

3 The reason is that depositors typically do not pay surcharges for the use of their own bank's ATMs, making it more desirable to open an account at a bank with many ATMs if it is surcharging.

obtainable in future periods from attracting a new customer in the current one, then the new customer is worth considerably more to the bank, and the extent to which such "footloose" customers are present in a market should make a greater difference to bank behavior than if only the current period is considered.

The use of a measure of in-migration cannot distinguish between these two models, since both imply a negative relationship between in-migration and price (a positive relationship between in-migration and deposit rates). This observational equivalence, however, does not arise for a measure of out-migration. The extent of out-migration from a market can influence the prices that banks charge or offer, but only if banks look to future periods and realize that a newly attracted customer is less valuable, the greater is the likelihood that that customer will migrate out of the market. Thus, out-migration measures should be positively related to price (negatively related to deposit rates) only if the bank considers the impact of attracting new customers during the current period on the profits obtainable in future periods. It is for this reason that measures of market out-migration will be employed in the analysis reported below.

3. The Model

The multi-period switching cost model to be employed borrows heavily from that presented in Beggs and Klemperer (1992) and discussed in Klemperer (1995). It will be adapted here to the case of bank deposit pricing and pursued to the extent needed to develop intuition for the underlying relationships to be examined empirically.

In the *t*th period of the multi-period model, each bank is assumed to maximize total discounted future profits, represented by

$$V_t^i = (r_s^t - r_{d.i}^t)[x_i + new_t Z_i^t(r_{d,i}^t, r_{d,j}^t, .)] + \delta V_{t+1}^i[\rho_{t,t+1}(x_i + new_t Z_i^t(r_{d,i}^t, r_{d,j}^t, .))] \quad (1)$$

where V_t^i denotes the discounted future profits of bank *i* at time *t*, r_s^t denotes the rate that banks can earn at time *t* by investing deposit funds in securities, $r_{d,i}^t$ denotes the rate that bank *i* offers depositors for deposits at time *t*, $r_{d,j}^t$ denotes the deposit rate offered by rival bank *j*, x^i denotes the number of firm *i*'s locked-in depositors, each of which is assumed to have one unit of deposits per period, new_t represents the number of new customers entering the market at period *t*, $\rho_{t,t+1}$ represents the proportion of depositors in the market at period *t* that survive to period *t+1*, δ denotes a discount factor, defined as the reciprocal of 1 plus the discount rate, and $Z_i^t(r_{d,i}^t, r_{d,j}^t, .)$ represents bank *i*'s share of new customers, assumed to be a positive function of bank *i*'s deposit rate, a negative function of rival bank *j*'s deposit rate, and potentially a function of other characteristics, to be discussed below.

For simplicity, we do not model the bank's loan pricing decision. We assume instead that banks hold some securities in their portfolios and that these are perfectly elastically supplied. This common assumption means that both deposit rates and loan rates are determined in part by the exogenous security rate, and that deposit pricing and loan pricing can be treated as separable.[4]

The second term in (1) reflects the discounted value of future profits at time *t+1*, V_{t+1}^i, which is a function of the number of customers that become locked in at time *t* (including new depositors attracted at time t), multiplied by the proportion that "survive"

4 See Klein (1971) for a fuller discussion.

to time *t+1*. Differentiation of (1) with respect to $r_{d,i}^t$ and division by the population of the market at time t yields:

$$\frac{\partial V_t^i}{\partial r_{d,i}^t} = -\frac{x_i}{pop_t} + \frac{new_t}{pop_t}[-Z_i^t(r_{d,i}^t, r_{d,j}^t, .) + (r_s^t - r_{d,i}^t)\frac{\partial Z}{\partial r_{d,i}^t} + \delta\rho_{t,t+1}V_{t+1}^{i'}(.)\frac{\partial Z}{\partial r_{d,i}^t}] = 0 \ , \qquad (2)$$

where $V'^{i}_{t+1}(.)$ denotes differentiation of V_{t+1}^i with respect to its determinant, pop_t denotes market population at time t, and all other terms are as previously defined.

The variable new_t/pop_t is a market variable indicating the rate of in-migration at time *t*. Because the expression in brackets in (2) must be positive to satisfy the first-order condition, it follows that (assuming the second-order condition is satisfied) an increase in the rate of in-migration causes the optimal level of $r_{d,i}^t$ to increase.[5] The reason is that, in the tradeoff between exploiting old depositors and attracting new ones, the bank finds it optimal to offer higher deposit rates, the larger the proportion of new customers in the market.

Next, consider the role of out-migration. We will assume that the proportion of a bank's depositors during period *t* that do not leave by period *t+1* may be approximated by the proportion of the population in the bank's market that do not leave the market during the period, or

$$\rho_{t,t+1} = 1 - (out_{t+1}/pop_t),$$

where out_{t+1} denotes the number of people migrating out of the market between periods *t* and *t+1*. Substitution into (2) and rearranging terms yields

5 In the interest of simplicity, formal comparative statics are not presented. This may be seen by noting that, with an increase in new_t/pop_t, the expression between the two equal signs in (2) becomes positive, requiring an increase in bank *i*'s deposit rate to restore it to zero.

$$-\frac{x_i}{pop_t}+\frac{new_t}{pop_t}[-Z_i^t(r_{d,i}^t,r_{d,j}^t,.)+(r_s^t-r_{d,i}^t)\frac{\partial Z}{\partial r_{d,i}^t}+\delta V_{t+1}^{i'}(.)\frac{\partial Z}{\partial r_{d,i}^t}]-\delta\frac{new_t}{pop_t}\frac{out_{t+1}}{pop_t}V_{t+1}^{i'}(.)\frac{\partial Z}{\partial r_{d,i}^t}=0 \quad . \qquad (3)$$

Because the last term on the left-hand side is negative (since $\partial Z/\partial r_{d,i}^t > 0$), an increase in the rate of out-migration from the market, out_{t+1}/pop_t, will cause the optimal level of $r_{d,i}^t$ to decline. Note that the rate of market in-migration, new_t/pop_t, also appears in this term, suggesting (if we wish to follow the implications of the model at this level of detail) that the negative impact of out-migration on bank *i*'s optimal deposit rate is quantitatively greater, the greater is the level of in-migration. The intuition is that greater out-migration deters banks from offering as high a deposit rate to attract new depositors, because it means that new depositors (on average) will not remain with the bank for as long as would otherwise be the case. In the extreme case, with no new depositors migrating into the market, out-migration should have no effect on optimal deposit rates.

It is also easily shown that an increase in the discount rate of the bank, implying a reduction in the discount term, δ, causes the optimal deposit rate to decline. The reason is that, in the tradeoff between exploiting old depositors and attracting new ones, the future benefits of attracting new depositors are weighted less heavily with an increase in the discount rate.

It bears emphasizing that this is not a complete model of deposit pricing. Nothing has been said about the equilibrium that might result from the interactions between bank *i*'s pricing decisions and those of its rivals. Further, nothing has been said about how out-migration and in-migration might adjust to each other as the number of depositors in the market changes as a result of in-migration and out-migration. Beggs and Klemperer (1992) present an analysis that accounts for these issues, with the rather stark assumptions that such an analysis typically requires.

In their analysis, the share of new customers obtained by the firm, expressed as $Z_i^t(r_{d,i}^t, r_{d,j}^t, .)$ in (1), is examined in the case of two firms, each located at opposite ends of a "Hotelling line." This allows the interaction between the two rivals to be addressed explicitly in this context.[6] This stark treatment, however, is not innocuous. It results in an implication much emphasized in Beggs and Klemperer (1992) and in Klemperer (1995). It may be seen by noting from (2) that a bank that has more locked-in depositors (denoted by a greater value of x_i) will offer a lower deposit rate than a bank with fewer locked-in depositors, all else equal. The reason is that, under the Beggs and Klemperer assumptions, the bank with more locked-in depositors has no inherent advantage in attracting new depositors (other than those associated with cost differences) when compared to the bank with few locked-in depositors. Thus, the larger bank, or the bank with greater market share, enjoys a heavier weighting of locked-in depositors, and this induces it to offer lower deposit rates (higher prices in the case of the non-banking firm) than do smaller institutions or institutions with smaller market shares.

Suppose, however, that the firm with more locked-in customers also has an advantage in attracting new customers. This would surely be the case in banking, since larger banks and banks with larger market shares typically operate more branches and ATMs than do smaller banks or banks with smaller market shares. In this case, it is not clear that a larger institution or an institution with a greater market share would face a different tradeoff between exploiting old customers and attracting new ones. Formally, suppose that the share of new depositors obtained by bank *i* could be expressed as

---

6 Beggs and Klemperer also assume a market steady state, in which the number of new customers in the market equates in the long run with the number of customers leaving the market. See Beggs and Klemperer, 1992 p. 654).

$$Z_i^t = brshare_i^t g_i^t(r_{d,i}^t, r_{d,j}^t), \quad (4)$$

where $g_i^t(.)$ is some function of deposit rates only, and $brshare_t^i$ denotes bank *i*'s share of branches in the market. This simply notes that, given deposit rates, the share of new depositors obtained by bank *i* will be proportionate to its share of branches. Suppose also that, as seems quite plausible, the bank's branch share is related linearly to the proportion of the market population that are locked-in depositors of bank *i*, as in

$$brshare_i^t = \alpha(x_i / pop_t), \quad (5)$$

where α is some positive constant. Substitution of (4) and (5) into (3) would cause the elimination of x_i / pop_t from the first- order condition, implying that the number of locked in customers of the bank (a proxy for the bank's size or market share) plays no role in determining deposit rates. The intuition is that, if larger banks enjoy an advantage in attracting new customers that is "equivalent" to their advantage in exploiting old ones, then the tradeoff between exploiting old customers and attracting new ones may be the same for large and small banks, implying no role for bank size (or market share) in the bank's pricing decision.

4. The Test

Given the above considerations, the empirical specification to be employed will be of the form

$$r_{d,i}^t = \beta_0 + \beta_1 hhi_m^{t-1} + \beta_2 \ln(mktinc_m^{t-1}) + \beta_3 inmigrate_m^{t-1} + \beta_4 outmigrate_m^{t-1}(inmigrate_m^{t-1}) + \nu_t + \mu_i + \varepsilon_{it}, \quad (6)$$

where $r_{d.i}^t$ denotes the retail deposit rate of bank *i* at time *t*, hhi_m^{t-1} denotes the Herfindahl-Hirschman index of concentration of market *m* at time $t-1$, $mktinc_m^{t-1}$ denotes the real

income of market *m* at time $t-1$, $inmigrate_m^{t-1}$ denotes the rate of in-migration observed for market *m* at time $t-1$, $outmigrate_m^{t-1}$ denotes the rate of out-migration observed for market *m* at time $t-1$, ν_t denotes a time-specific fixed effect, μ_i denotes bank-specific fixed effect, and ε_{it} denotes an idiosyncratic error term. An indicator of whether the bank operates predominantly in urban or rural markets and, in some estimations, measures of bank size, bank market share, and market population growth are also included. Explanatory variables are lagged because of the likelihood that it takes some time for banks to set deposit rates after a change in the market characteristics that influence those rates.

The natural log of real market income ($mktinc_m^{t-1}$) plays an important role in these regressions, since it accounts for changes in the size of the market that might otherwise be incorrectly attributed to in-migration or out-migration. If banks set deposit rates based on an exogenously determined security rate, r_s^t, as modeled in (1), then a shift in market income can influence deposit rates only by shifting the supply of deposits, implying, in all likelihood, a negative relationship between $mktinc_m^{t-1}$ and bank deposit rates. An increase in market income, however, would likely also cause an increase in the demand for bank loans, and this could intern increase bank demand for deposit dollars if banks do not price deposits based on an exogenously determined security rate. In case, the coefficient of $mktinc_m^{t-1}$ is not suggested. The natural log of this market variable is employed because it is highly positively skewed, and it is not reasonable to expect it to exhibit a linear relationship with deposit rates over the large range of values observed in the data.

As for coefficient predictions, the traditional Structure-Conduct-Performance (SCP) hypothesis implies that $\beta_1 < 0$ if operation in a more concentrated market makes the exercise of market power more likely or more pronounced, resulting in lower deposit rates, all else equal. If a greater rate of in-migration of new customer implies higher deposit rates, and if greater rate of out-migration of customers from the market implies lower deposit rates, as derived above, then

$$\beta_3 + \beta_4 outmigrate_m^{t-1} > 0 \quad \text{and} \quad \beta_4 < 0 . \tag{7}$$

Since $outmigrate_m^{t-1}$ is a positive number, it follows also that $\beta_3 > 0$. These predictions will be tested by estimating (6) using panel data estimations with year and bank fixed effects..

5. The Data

The data set employed in the analysis consists of observations of individual banks observed annually from 1989 to 2004, yielding over 130,000 bank-year observations. For each bank and year, the interest rate measures were obtained for four different types of retail deposit accounts. These are: the rate for interest bearing transactions accounts (denoted *itrate*), the rate for savings deposits (denoted *svrate*), the rate for time deposits less than $100 thousand (denoted *smtrate*), and the rate for time deposits greater than $100 thousand (denoted *lgtrate*). Interest bearing transaction accounts include NOW accounts, ATS accounts, and telephone and preauthorized transfer accounts, while savings accounts include money market deposit accounts and “other savings accounts,” as indicated on bank income and call report data. Interest rates for each account category were calculated by dividing the reported annual interest expense by the average of the beginning and end-of- year dollar values of the accounts held. Due primarily to reporting

errors, this procedure can produce some fairly unrealistic estimates of deposit rates. To reduce the impact of such errors, observations containing the largest and smallest one percent of values in each account category are eliminated from the analysis.

The most unique source of data employed in the analysis is that used to measure market-specific rates of in-migration and out-migration. These measures are calculated using the county-to-county migration data collected and reported annually by the Internal Revenue Service (IRS). These data are constructed from year-to-year changes in addresses shown on the population of returns from the IRS Master File system. For each county in the country, these data indicate the number of filers that immigrated into the county during the year (identified by an address in the county at the time of filing and an address outside the county at the time of the previous year's filing), the filers that emigrated out of the county during the previous year (identified by an address outside the county at the time of the filing and an address inside the county at the time of the previous year's filing), and the filers that did not migrate in or out of the county during the previous year (identified by an address in the county at the time of both filings).

An issue associated with the use of these data concerns the choice between the number of returns and the number of exemptions associated with the returns, both of which are available from this data source. The number of returns should approximate the number of households, while the number of exemptions should approximate the population. We employ migration data as reflected in the number of returns, since household migration would seem to be a better measure of bank account activity than a measure heavily influenced by the number of family members.

Another issue concerns the treatment of multi-county markets. Following previous studies,[7] markets are defined, in the case of urban markets, as the county or the collection of counties that make up a metropolitan area. Rural markets are defined as labor market areas, as defined by the Bureau of Labor Statistics. These labor market areas are typically identical to counties, but sometimes they form larger areas obtained by combining counties when 15 percent or more of the employed workers in one county commute to another.[8] For multi-county markets, an issue arises concerning the appropriate treatment of migration from one county to another in the same market. For the purpose of this paper, such migration is not counted as relevant to the pricing of banks in the defined market. Such moves are therefore netted out in calculating migration into and out of multi-county markets.

For these markets, as defined, the rate of in-migration (*inmigrate*) is constructed as the number of new filers in the market, divided by the total number of filers, where both numerator and denominator are measured for the tax year previous to the year for which deposit rates are observed.[9] The rate of out-migration (*outmigrate*) is measured as the number of filers who left the market, divided by the total number of filers, where the numerator refers to the tax year for which deposit rates are observed, and the denominator refers to the tax year previous to the year for which deposit rates are observed. This difference in timing used to measure the rates of in-migration and out-migration reflects the fact that the rate of out-migration logically requires information for

7 See, for example, Hannan and Prager (2004), Berger and Hannan (1989), and Calem and Carlino (1991).

8 See http:/www.bls.gov/lar/laugero.htm#geolma for a detailed discussion.

9 This, in essence, indicates the importance of new depositors that could be observed by banks at the beginning of the year for which deposit rates are measured, and this seems preferable to a measure that would apply to the end of the year.

two consecutive periods (the period in which filers were observed to have left and the period in which those same filers were observed to be in the market), while the rate of in-migration does not. Since these are market-specific calculations, banks operating in more than one market are assigned a weighted average of these values, where the weights are the shares of the bank's total deposits booked in the markets in which it operates.

Other variables employed in the analysis include the Herfindahl-Hirschman index of concentration (*hhi*), the extent to which a bank operates in an urban markets (*urban*), and the natural log of the income (adjusted for inflation) of the market or markets in which each bank operates (denoted *ln(mktincome)*). As discussed in more detail below, inclusion of this latter variable is of particular importance, because differences in in-migration and out-migration might be correlated with changes in the size of the market over time, and it is important to control for any unobservable factors (such as an increase in demand for bank service or an increase in the supply of deposits) that result simply from a change in the size of the market over time. As a check on robustness, some estimations will also include as explanatory variables the rate of population growth of the markets in which each bank operates (*popgrowth*), the natural log of the total assets of the banking organization (*ln(bkasst)*), and the bank's share of branches in the market (*branchshare*).

Data to calculate market shares and the Herfindahl-Hirschman index, defined as the sum of squared market shares (measured in deposits) of all banks and thrift institutions operating in the market, are obtained annually from branch-specific information on institution deposits, as reported in the Federal Deposit Insurance Corporation's Summary of Deposits and the Office of Thrift Supervision's Branch Office

Survey. Data on market income are obtained from the Department of Commerce's Regional Accounts Data, while data on market population are obtained from the U.S. Bureau of the Census. The assets of each banking institution are obtained from bank balance sheet data. In the case of banks that operate in more than one local market, all market-specific variables are calculated as weighted averages of market values, with the share of each bank's total deposits that are booked in each market serving as the weights. All of these variables are lagged one year because of a probable lag between the generation of revenue used in the calculation of the deposit rates and the setting of a deposit rates as a result of the observed market and bank characteristics.

6. The Results

Table 1 defines all variables employed in the analysis, and table 2 presents the mean values, by year, of all four deposit rates and of the two variables of primary interest in the analysis, *inmigrate* and *outmigrate*. Note from table 2 that the period from 1989 to 2004 was one of generally declining deposit rates. The mean values of the rates paid on interest-bearing transaction accounts (*itrate*) declined from .048 in 1989 to .011 by 2002, approaching zero thereafter, while the typically higher rates paid on large and small time deposits (*smtrate* and *lgtrate*) continued to decline through 2004. A desire on the part of banks to pay some positive rate for interest-bearing transaction accounts and, to a lesser extent, for savings accounts may account for the "asymptotic approach" to zero of the mean values of *itrate* and *svrate* by 2003 and 2004. The mean values of the rate of in-migration and out-migration (*inmigrate* and *outmigrate*) varied from .057 to .063 over the

period. The maximum annual values for these variables (not shown) ranged from .22 to .25.

Table 3 presents the results of panel data estimations, including both bank and year fixed effects, obtained using the entire sample of over 12,500 banks observed annually over the period 1989 to 2004. The first four columns of table 3 present results obtained for each of the four deposit interest rates when the in-migration rate (*inmigrate*) is included as an explanatory variable and the rate of out-migration is excluded. As indicated, the coefficients of *inmigrate* are positive and highly significant in all four regressions, consistent with the hypothesis that banks offer higher deposit rates to attract new customers when the share of customers in the market that can be more readily attracted by higher deposit rates is greater. This finding is generally consistent with results reported by Sharpe (1997) and Hannan et. al. (2003), who report similar findings using different measures of bank prices and much more restrictive data sets. Coefficient magnitudes suggest that a one percentage point increase in the rate of in-migration would cause deposit rates to increase by 2.3 basis points in the case of interest-bearing transaction accounts, 2.0 basis points in the case of savings deposits, 1.7 basis points in the case of small time deposits, and 3 basis point in the case of large time deposits.

The model by Beggs and Klemperer (1992) does not derive differences in the relationships between prices and these variables across products that may have different levels of switching costs; that is, no product-specific differences in the degree to which old customers are locked in by their past purchases are incorporated in the model. One might nonetheless suspect that differences in in-migration would have a larger effect in the case of products for which switching costs should be more important. It is interesting

to note from the coefficients of *inmigrate* that, as a percentage of the average value of the deposit rates, changes in inmigration make the biggest difference in the case of interest-bearing transaction accounts (*itrate*), where one would expect switching costs to be the greatest. Coefficient magnitudes, however, are not statistically different from each other.

Another issue relevant to the existence of switching costs concerns the extent of the decline over time in the four different deposit rates. All reported regressions include a full set of dummy variables indicating the year, with the first year, 1989, serving as the excluded category. For reasons of space, only the coefficients for three relatively late years in the sample, 2000, 2002, and 2004, are reported. With 1989 serving as the excluded category, these coefficients may be interpreted as the change in the deposit rates occurring over the relatively long periods of 1989 to 2000, 1989 to 2002, and 1989 to 2004, respectively, that cannot be explained by changes in the included explanatory variables. As indicated, even in absolute terms, the unexplained reduction in the deposit rates by 2000 was the greatest in the case of interest-bearing transaction accounts, and since deposit rates for interest-bearing transaction accounts are invariably lower than those paid on other accounts, these differences are even more pronounced in percentage terms.

A possible explanation for this difference is the increasing importance of switching costs over time as a result of direct deposit and automatic payment arrangements, which would presumably affect interest-bearing transaction accounts more than other types of deposit accounts. Ultimately, however, since these differences in the decline in deposit rates could be due to any number of factors (such as relative changes in costs over time), this explanation must be considered speculative. The smaller absolute decline observed

for *itrate* relative to other rates by 2002 and 2004 probably reflects the fact that the rate on interest-bearing transaction deposits was approaching the floor of zero in the last years of the study.

The coefficients of the other explanatory variables are also of interest. The coefficients of the Herfindahl-Hirschman index (*hhi*) are negative in all four regressions and statistically significant in three of them, consistent with the greater exercise of market power in more concentrated markets. The positive and statistically significant coefficient of *urban* in three of the four regressions suggests that, with the exception of the rate on interest-bearing transaction accounts, the deposit rate that a bank offers tends to rise, the larger its share of deposits that come from urban markets. The natural log of real market income over time, *ln(mktincome),* is, except in the case of *svrate*, not significantly related to deposit rates.

The final four regressions reported in table 3 repeat the first four, except that the interaction between the rates of market in-migration and out-migration (*outmigrate x inmigrate*) is added as an additional explanatory variable in each regression, as derived above. As indicated, the coefficients of this added variable are negative and highly significant in all four regressions, consistent with the hypothesis that banks tend to price less aggressively to attract new depositors, the shorter the time that locked-in depositors are expected to remain customers of the bank. Note further that the coefficients of *inmigrate* are positive and highly significant in all four regressions, with coefficients that are substantially greater in magnitude than those reported in the first four regressions. As can be seen from (7), this greater magnitude in the coefficients of *inmigrate* is predicted because, with the interaction term (*outmigrate x inmigrate)* included in the

regression, the coefficients of *inmigrate* indicate the impact of a change in the in-migration rate for the case in which there is no out-migration. With no out-migration, an increase in the rate of in-migration has a bigger impact on pricing to attract new customers, because a new locked-in customer is more valuable to the bank.

The relative magnitudes of the coefficients of *inmigrate* and its interaction with *outmigrate* are also of interest, since they indicate how high the rate of out-migration would have to be for the rate of in-migration to have no net positive impact on deposit rates. This appears to be in the neighborhood of 0.25. Since the data contain no case of a rate of out-migration that is any higher than this, coefficient point estimates suggest some positive effect of the rate of in-migration for virtually all banks in the sample. Substitution of *outmigrate* for *outmigrate x immigrate* in these regressions (not reported) yields negative and statistically significant coefficients of *outmigrate* in all regressions.[10] The coefficients of all other variables reported in these four regressions are similar to their counterparts in the regressions presented in the first four columns and will therefore not be discussed.

To examine these relationships further, table 4 presents results obtained by dividing the full sample into urban and rural subsamples, using the full specification employed in the last four columns of table 3. Banks are classified as urban if more than half of their deposits are in branches located in urban markets and are classified as rural otherwise. As indicated, the urban sample is somewhat smaller than the rural sample in terms of number of banks and observations.

[10] Interactions of *inmigrate* with dummy variables indicating ranges of *outmigrate* (rather than with *outmigrate* itself) confirm that the positive effect of *inmigrate* falls off at higher ranges of *outmigrate* (not reported). Coefficient magnitudes, however, suggest that this decline is less pronounced than that predicted by a single continuous interaction term for most of the observed range of *outmigrate*.

Of primary importance is the fact that in both subsamples, the coefficients of *inmigrate* are positive and highly significant and the coefficients of *outmigrate x inmigrate* are negative and highly significant for all four deposit rates examined. An interesting difference is that the absolute value of the magnitudes of these coefficients are invariably greater for predominantly urban banks than predominantly rural banks. Thus, the pricing at predominantly urban banks tends to be more responsive to differences in migration patterns than is the case at predominantly rural banks.

Some differences in the coefficients of the other variables employed in the analysis are noteworthy. While the coefficients of *hhi* are negative in all cases, these coefficients are statistically significant for small and large time deposits in the case of predominantly urban banks and for interest-bearing transaction accounts and savings accounts in the case of predominantly rural banks. The extent to which a bank obtains its deposits from urban markets, *urban*, is included in all estimations, since this variable can vary substantially even within the rural and urban subsamples. As indicated, signs and statistical significance of this variable can differ across the two subsamples.

Because the period from 1989 to 2004 is quite long, the underlying assumption of constant coefficients over this entire period is examined by dividing the sample into two subsamples, one for the earlier half of the period and one for the later half. In table 5, the first four columns report results obtained by restricting the sample to the years 1989 to 1996, while the last four columns report results obtained for the period 1997-2004.

For both subsamples, the coefficient of *inmigrate* is positive and highly significant for each of the four deposit account types examined, and the coefficients of *outmigrat x inmigrate* are negative and highly significant in all cases. In terms of

coefficient magnitudes, absolute values of these coefficients tend to be smaller in the later period, perhaps because of the lower interest rates that prevailed in this period, as documented in table 2.

For the other variables included the estimations, the coefficients of *urban* appear to be somewhat more consistently positive and significant in these regressions, while the coefficients of *ln(mktincome)* appear somewhat more negative and significant.

The coefficients of the year dummy variables are reported only for 1996 in the case of the earlier period and only for 2004 in the case of the later period. Since no dummy variable for 1989 is included in the first four regressions and no dummy variable for 1997 is included in the last four regressions, the coefficients of the 1996 variable may be interpreted as the unexplained change in deposit rates from 1989 to 1996, and that for 2004 variable may be interpreted as the unexplained change in deposit rates from 1997 to 2004, that are not accounted for by changes in the included explanatory variables. For the earlier period, the drop in deposit rates unexplained by changes in the included explanatory variables was, by a small margin, greatest in absolute terms (and substantially greater in percentage terms) in the case of the rate offered on interest-bearing transaction accounts. This was not the case for the later period, perhaps because, as noted above, this deposit rate approached zero toward the end of the 1997-2004 period.

Estimations reported in table 6 examine the robustness of these results by including additional explanatory variables. To save space, coefficients of the year dummy variables are not shown, and only results for the two account categories that should entail the highest switching costs--interest-bearing transaction accounts and savings accounts--are reported. For each of these account types, the natural log of bank

assets, the bank's branch share, and market population growth are added as additional explanatory variables.

The natural log of bank assets and branch share are included in part because of the prediction by Beggs and Klemperer (1992) and Klemperer (1995) that larger firms or firms with larger market shares should charge higher prices (offer lower deposit rates in this case). These variables have not been included in previous tables because, despite the fact that they are lagged one year, their coefficients may reflect some degree of endogeneity bias. As indicated, the coefficients of the log of bank assets, *ln(bkassets)*, is positive and significant in the case of interest-bearing transaction accounts and insignificant in the case of savings deposits, while the coefficient of branch share is negative and marginally significant in the case of interest-bearing transaction accounts and insignificant in the case of savings deposits.[11] For interest bearing transaction accounts, the negative coefficient of branch share is consistent with the predictions of Beggs and Klemperer (1992) and Klemperer (1995), while the positive coefficient of the bank size variable is not.

The rate of market population growth is included because of its obvious association with in-migration and out-migration. This association raises the possibility that the coefficients of the variables measuring in-migration and out-migration are obtained not for the reasons outlined above, but simply because of unmeasured phenomena associated with market growth. As noted above, *ln(mktincome)* is included in all estimations to account for such phenomena, so the inclusion of *popgrowth* may be considered a further check on this issue. As indicated, the coefficients of *popgrowth* are in both cases positive and significant. As also indicated, the inclusion of this variable, as

11 Branch share is chosen over deposit share to reduce at least some sources of potential endogeneity bias.

with the inclusion of *ln(bkasset)* and *branchshare*, leaves the coefficients associated with in-migration and out-migration unchanged in sign and statistical significance.

7. Conclusion

This paper employs extensive information on deposit rate setting by banks to test for the existence of pricing relationships implied by the existence of switching costs. As argued, the banking industry is one in which substantial switching costs should be relevant to customer behavior. Furthermore, the local nature of the markets for some types of retail deposit accounts, together with extensive information on the rate at which new customers enter and exit these markets, makes possible the testing of these relationships in ways not available in other empirical settings.

While these relationships are derived more formally, the intuition for them can be readily stated. Because some areas experience more in-migration than others, banks, in addressing the tradeoff between attracting new customers and exploiting old ones, should offer higher deposit rates in areas (and during periods) characterized by greater in-migration. Further, because out-migration implies that on average a locked-in customer will not be with the bank as many periods, greater out-migration should change the bank's assessment of this trade-off such that the bank will offer lower deposit rates in areas (and at times) exhibiting greater out-migration, all else equal. Also, because this effect of out-migration logically depends on the existence and extent of in-migration, an interaction effect is implied.

Other tests of the implications of switching costs in the banking industry are suggested by the fact that some deposit products of banks should exhibit greater

switching costs than others and that switching costs, because of the increasing popularity of direct deposit and automatic withdrawal arrangements involving other entities, have been rising over time. This could imply a greater relative decline in deposit rates for account types where switching costs should be more of a factor.

Consistent with predictions, deposit rates are found to increase with the rate of migration into a market and decline with the rate of migration out of the market, with the rate of out-migration having a more negative effect on deposit rates, the higher is the rate of in-migration. Coefficients are robust and highly significant. They imply that switching costs are very much a factor in explaining bank deposit rates and that banks consider the future profitability of locked-in depositors in choosing current deposit rates.

These results are also relevant to antitrust policy as currently practiced in the banking industry. In assessing the impact of proposed mergers that might otherwise be judged anti-competitive, bank regulators typically consider "mitigating factors," such as the prospects for future market entry. These results suggest that migration patterns are also highly relevant to such an assessment.

Hypotheses based on the presumed differences in switching costs across the four different types of deposit accounts examined in the study are not as well supported. While the deposit account that should entail the most switching costs does exhibit the largest decline over the most relevant periods examined—a possible implication of rising switching costs—the possibility of other explanations for such cross-product differences implies that this result should be considered at best suggestive.

References

Amel, Dean F., and Martha Starr-McCluer. "Market Definition in Banking: Recent Evidence," The *Antitrust Bulletin* 47 (2002), pp. 63-89.

Beggs, A. and Paul Klemperer. "Multiperiod Competition with Switching Costs," *Econometrica* 60 (1992) pp. 651-666.

Berger, Allen N., and Timothy H. Hannan. "The Price-Concentration Relationship in Banking," *Review of Economics and Statistics* 71 (May 1989) pp. 291-299.

Calem, Paul, and G. Carlino. "The Concentration/Conduce Relationship in Bank Deposit Markets," *Review of Economics and Statistics* 72 (1991) pp. 268-276.

Farrell, Joseph, and Paul Klemperer. "Coordination and Lock-in: Competition with Switching Costs and Network Effects," Discussion Paper No. 5798, Centre for Economic Policy Research (August 2006).

Hannan, Timothy H., Elizabeth K Kiser, Robin A. Prager, and James J. McAndrews. "To Surcharge or not to Surcharge: An Empirical Examination of ATM Pricing," *Review of Economics and Statistics* 85(4) (2003) pp. 990-1002.

Hannan, Timothy H., and Robin Prager. "The Competitive Implications of Multimarket Branching," *Journal of Banking and Finance* 28 (2004) pp. 1889-1914.

Kim, Moshe, Doron Kliger, and Bent Vale. "Estimating Switching Costs and Oligopolistic Behavior," *Journal of Financial Intermediation* 12 (January 2003) pp. 25-56.

Kiser, Elizabeth, K. "Predicting Household Switching Behavior and Switching Costs at Depository Institutions," *Review of Industrial Organization* 20 (2002) pp. 349-365.

Klein, M. A. "A Theory of the Banking Firm," *Journal of Money, Credit and Banking* 2 (1971) pp. 261-275.

Klemperer, Paul. "Competition when Consumers have Switching Costs: An Overview with Applications to Industrial Organization, Macroeconomics, and International Trade," *Review of Economic Studies* 62 (1995) pp. 515-539.

Sharpe, Steven A. "The Effect of Consumer Switching Costs o Prices: A Theory and its Application to the Bank Deposit Market," *Review of Industrial Organization* 12 (1997) pp. 79-94.

Shy, O. "A Quick-and-Easy Method for Estimating Switching Costs," *International Journal of Industrial Organization* 20 (2002) pp. 71-87

Table 1

Variable Definitions

itrate	The interest rate offered on interest-bearing transaction accounts, calculated from bank income and balance sheet data (see text).
svrate	The interest rate offered on savings accounts, calculated from bank income and balance sheet data (see text).
smtrate	The interest rate offered on small time deposit accounts (less than $100 thousand), calculated from bank income and balance sheet data (see text).
lgtrate	The interest rate offered on large time deposit accounts greater than or equal to $100 thousand), calculated from bank income and balance sheet data (see text).
hhi	The market Herfindahl-Hirschman index of concentration, calculated as the sum of squared deposit shares of all banks and thrift institutions in the market. Banks operating in multiple markets are assigned a weighted average, with the share of the bank's total deposits in each market serving as the weights.
urban	The share of total deposits booked at branches located in markets classified as urban.
ln(mktincome)	The natural log of total income in the market, adjusted for changes in the CPI. Banks operating in multiple markets are assigned a weighted average, with the share of the bank's total deposits in each market serving as the weights.
inmigrate	The rate of migration into the market, calculated as the proportion of all IRS personal returns filed in the market that had addresses indicating a move into the market since the previous filing (see text). Banks operating in multiple markets are assigned a weighted average, with the share of the bank's total deposits in each market serving as the weights.
outmigrate	The rate of migration out of the market, calculated as the proportion of all IRS personal returns filed in the market that had addresses indicating a move out of the market by the subsequent filing (see text). Banks operating in multiple markets are assigned a weighted average, with the share of the bank's total deposits in each market serving as the weights.
ln(bkasset)	Natural log of the assets of the bank.
branchshare	The bank's share of all branches of banks and savings associations in the market. Banks operating in multiple markets are assigned a weighted average, with the share of the bank's total deposits in each market serving as the weights.
popgrowth	Annual rate of population growth of the market. Banks operating in multiple markets are assigned a weighted average, with the share of the bank's total deposits in each market serving as the weights.

Table 2

Means of Deposit Rates and Migration Variables,by Year

	itrate	*svrate*	*smtrate*	*lgtrate*	*inmigrate*	*outmigrate*
1989	.048	.055	.081	.077	.058	.064
1990	.049	.056	.079	.075	.060	.064
1991	.045	.051	.071	.065	.061	.058
1992	.031	.037	.053	.047	.061	.061
1993	.024	.029	.043	.038	.062	.060
1994	.023	.029	.042	.039	.062	.060
1995	.024	.032	.056	.054	.063	.061
1996	.023	.032	.056	.052	.061	.060
1997	.023	.033	.056	.054	.061	.062
1998	.023	.033	.056	.054	.060	.062
1999	.021	.032	.052	.050	.060	.063
2000	.023	.035	.057	.057	.060	.063
2001	.018	.028	.057	.055	.059	.063
2002	.011	.017	.040	.035	.059	.061
2003	.007	.011	.029	.028	.057	.058
2004	.006	.010	.025	.024	.057	.058

Table 3

Bank Deposit Rates, and the Extent of In-migration and Out-migration
in Local Banking Markets, 1989-2004, with Bank and Year Fixed Effects

Dependent Variables:	*itrate*	*svrate*	*smtrate*	*lgtrate*	*itrate*	*svrate*	*smtrate*	*lgtrate*
constant	.046	.057	.080	.076	.047	.058	.079	.076
	(38.28)	(44.75)	(67.37)	(41.18)	(36.81)	(43.09)	(62.37)	(38.78)
hhi	-.18E-6**	-.19E-6**	-.84E-7	-.20E-6+	-.20E-6**	-.20E-6*	-.13E-6	-.27E-6*
	(-2.62)	(-2.68)	(-1.20)	(-1.68)	(-2.83)	(-2.64)	(-1.64)	(-2.14)
urban	-.48E-3	.0033**	.0017**	.0022*	-.43E-3	.0033**	.0015**	.0022**
	(-.93)	(6.13)	(3.29)	(2.62)	(-.79)	(6.04)	(2.92)	(2.48)
ln(mktincome)	.11E-3	-.0024*	-.18E-4	-.76E-4	.44E-4	-.36E-3**	-.92E-4	-.11E-3
	(1.29)	(-2.50)	(-.20)	(-.55)	(.48)	(-3.66)	(-.98)	(-.75)
inmigrate	.023**	.020**	.017**	.030**	.047**	.055**	.068**	.060**
	(7.11)	(5.70)	(5.01)	(4.92)	(9.49)	(10.20)	(11.55)	(6.58)
outmigrate x inmigrate					-.18**	-.29**	-.43**	-.23*
					(-4.90)	(-7.20)	(-8.82)	(-3.59)
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
year 2000	-.027**	-.022**	-.025**	-.021**	-.27**	-.022**	-.025**	-.021**
	(-237.49)	(-176.23)	(-249.73)	(-95.46)	(-238.04)	(-176.33)	(-250.15)	(-95.15)
.	.	.	.	.	.	.	.	.
year 2002	-.039**	-.039**	-.044**	-.042**	-.039**	-.039**	-.044**	-.042**
	(-395.02)	(-362.15)	(-406.32)	(-197.01)	(-393.00)	(-359.07)	(-404.36)	(-195.66)
.	.	.	.	.	.	.	.	.
year 2004	-.043**	-.046**	-.052**	-.054**	-.043**	-.046**	-.057**	-.054**
	(-464.03)	(-455.45)	(-498.49)	(-252.61)	(-455.94)	(-446.23)	(-539.71)	(-249.24)
R^2-within	.87	.87	.90	.70	.87	.86	.89	.69
Number of observations	134,961	134,961	134,967	134,961	128,409	128,409	128,409	128,409
Number of banks	12,771	12,771	12,771	12,771	12,650	12,650	12,650	12,650

Note: t-statistics are presented in parentheses. The symbols +, *, and ** denote significance at the 10, 5, and an 1 percent levels, respectively. For purposes of space, coefficients of only three of the year binary variables are presented (coefficients relative to 1989).

Table 4

Bank Deposit Rates, and the Extent of In-migration and Out-migration
in Urban and Rural Banking Markets, 1989-2004, with Bank and Year Fixed Effects

	Urban				Rural			
Dependent Variables:	*itrate*	*svrate*	*smtrate*	*lgtrate*	*itrate*	*svrate*	*smtrate*	*lgtrate*
constant	.043	.049	.076	.067	.050	.061	.081	.081
	(10.05)	(9.99)	(17.24)	(10.11)	(23.90)	(30.05)	(42.15)	(28.57)
hhi	-.12E-6	-.24E-6	-.48E-6**	-.91E-6**	-.19E-6*	-.18E-6**	-.42E-7	-.16E-6
	(-.77)	(-1.26)	(-2.78)	(-2.85)	(-2.31)	(-2.22)	(-.48)	(-1.18)
urban	-.16E-3	.0032**	.0022*	-.75E-3	-.0020*	-.76E-3	-.0013	.0021
	(-.14)	(2.78)	(1.95)	(-.41)	(-2.42)	(-.94)	(-1.62)	(1.39)
ln(mktincome)	.22E-3	.10E-3	.17E-3	.72E-3+	-.11E-3	-.47E-3**	-.15E-3	-.52E-3*
	(.89)	(.34)	(.63)	(1.82)	(-.64)	(-2.95)	(-1.03)	(-2.34)
inmigrate	.054**	.079**	.076**	.075**	.029**	.023**	.053**	.034**
	(4.64)	(6.55)	(5.46)	(3.64)	(5.39)	(4.03)	(8.69)	(3.31)
outmigrate x inmigrate	-.28**	-.34**	-.52**	-.30*	-.13**	-.17**	-.35**	-.13*
	(-3.44)	(-3.88)	(-5.09)	(-1.96)	(3.18)	(-4.13)	(-7.02)	(-2.00)
.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.
year 2000	-.028**	-.022**	-.025**	-.023**	-.026**	-.021**	-.024**	-.0019**
	(-132.23)	(96.15)	(-127.12)	(-60.31)	(-189.01)	(-142.92)	(-212.75)	(-69.13)
.	.	.	.	.	.	.	.	.
year 2002	-.040**	-.041**	-.045**	-.045**	-.038**	-.038**	-.043**	-.040**
	(-203.20)	(-202.20)	(-215.82)	(-117.37)	(-31.29)	(276.39)	(-325.06)	(-145.71)
.	.	.	.	.	.	.	.	.
year 2004	-.043**	-.048**	-.058**	-.056**	-.043**	-.045**	-.056**	-.052**
	(-224.38)	(-232.05)	(-271.93)	(-143.54)	(-363.69)	(-348.27)	(-438.57)	(-187.79)
R^2-within	.85	.86	.86	.70	.89	.86	.92	.68
Number of observations	52,095	52,095	52,095	52,095	75,876	75,876	75,876	75,876
Number of banks	6,123	6,123	6,123	6,123	6,766	6,766	6,766	6,766

Note: t-statistics are presented in parentheses. The symbols +, *, and ** denote significance at the 10, 5, and an 1 percent levels, respectively. For purposes of space, coefficients of only three of the year binary variables are presented (coefficients relative to 1989).

Table 5

Bank Deposit Rates and the Extent of In-migration and Out-migration
in Local Banking Markets, for periods 1989-1996 and 1997-2004, with Bank and Year Fixed Effects

	1989-1996				1997-2004			
Dependent Variables:	*itrate*	*svrate*	*smtrate*	*lgtrate*	*itrate*	*svrate*	*smtrate*	*lgtrate*
constant	.045 (20.67)	.055 (24.12)	.084 (35.75)	.085 (17.05)	.024 (16.03)	.039 (23.34)	.057 (33.35)	.058 (25.39)
hhi	-.91E-7 (-.92)	-.58E-7 (-.05)	-.33E-6** (-2.88)	-.45E-6+ (-1.95)	-.20E-6+ (-1.90)	-.73E-7 (-.67)	-.11E-6 (-.94)	-.26E-6 (-1.49)
urban	-.38E-3 (-.43)	.0020* (2.12)	.0027* (2.39)	.0046* (2.29)	-.60E-3 (-.76)	.0028** (3.08)	.0011 (1.32)	.0033** (2.93)
ln(mktincome)	.10E-3 (.64)	-.28E-3+ (-1.65)	-.46E-3** (-2.69)	-.88E-3* (-2.37)	-.14E-3 (-1.26)	-.60E-3** (-4.99)	-.26E-3* (-2.04)	-.41E-3* (-2.48)
inmigrate	.064** (10.74)	.078** (11.64)	.073** (10.22)	.066** (5.22)	.030** (4.39)	.045** (5.68)	.066** (7.83)	.044** (3.87)
outmigrate x inmigrate	-.20** (-4.73)	-.29** (-5.79)	-.38** (-6.96)	-.14* (-2.37)	-.13* (-2.62)	-.39** (-5.94)	-.58** (-7.69)	-.37** (-4.14)
.	.	.	.	.				
.	.	.	.	.				
year 1996	-.026** (-264.30)	-.024** (236.43)	-.025** (-251.35)	-.025** (-114.75)				
.					.	.	.	.
.					.	.	.	.
year 2004					-.018** (-206.20)	-.023** (-254.25)	-.032** (-371.87)	-.030** (-208.28)
R^2-within	.87	.84	.88	.69	.76	.84	.91	.77
Number of observations	71,927	71,927	71,927	71,927	56,482	56,482	56,482	56,482
Number of banks	11,428	11,428	11,428	11,428	9,094	9,094	9,094	9,094

Note: t-statistics are presented in parentheses. The symbols +, *, and ** denote significance at the 10, 5, and an 1 percent levels, respectively. For purposes of space, coefficients of only the last of the year binary variables are presented (coefficients relative to 1989 for first period and 1997 for the second period).

Table 6

Bank Deposit Rates and the Extent of In-migration and Out-migration in Local Banking Markets, 1989-2004, Additional Explanatory Variables with Bank and Year Fixed Effects

Dependent Variables:	*itrate*	*itrate*	*itrate*	*svrate*	*svrate*	*svrate*
constant	.042 (26.59)	.047 (36.88)	.0044 (3.34)	.058 (35.87)	.058 (43.11)	.012 (8.51)
hhi	-.23E-6** (-3.18)	-.16E-6* (-2.09)	-.19E-6** (-2.63)	-.20E-6** (-2.60)	-.17E-6* (-2.10)	-.17E-6** (-2.28)
urban	-.31E-3 (-.58)	-.57E-3 (-1.06)	-.63E-3 (-1.14)	-.0033** (6.01)	.0032** (5.75)	.0030** (5.37)
ln(mktincome)	-.83E-4 (-.88)	.47E-4 (.51)	.55E-4 (.60)	-.34E-3** (-3.45)	-.35E-3** (-3.64)	-.32E-3** (-3.31)
inmigrate	.049** (9.86)	.047** (9.51)	.026** (4.92)	.055** (10.15)	.056** (10.22)	.040** (6.89)
outmigrate x inmigrate	-.49** (-4.97)	-.19** (-4.93)	-.15** (-4.19)	-.29** (-7.19)	-.29** (-7.22)	-.26** (-6.68)
ln(bkassets)	.61E-3** (6.22)			-.71E-4 (-.65)		
. *branchshare*		-.0012+ (-1.69)			-.78E-3 (-1.06)	
. *popgrowth*			.016** (6.70)			.057* (2.25)
R^2-within	.87	.87	.86	.87	.86	.85
Number of observations	128,408	128,408	118,852	128,408	128,408	118,852
Number of banks	12,649	12,649771	12,262	12,649	12,649	12,262

Note: t-statistics are presented in parentheses. The symbols +, *, and ** denote significance at the 10, 5, and an 1 percent levels, respectively. For purposes of space, coefficients of only three of the year binary variables are presented (coefficients relative to 1989).